

**REMARKS**

Claims 1, 3-9, and 12-20 are pending in the application. In the specification, “ammonium chloride (NH<sub>4</sub>OH)” has been amended to “ammonium hydroxide (NH<sub>4</sub>OH)” in paragraph [0083] at page 11 to correct a typographical error. The amendment to the specification is supported by the adjacently recited correct chemical formula, NH<sub>4</sub>OH. Claims 1, 4, 13, 16, and 18 has been amended to correct syntax errors by replacing “catalytic metal” with “catalytic metal compound”. Claim 9 has been amended to further clarify the language. Support for amended claim 1 can be found at pages 6 and 10 in the specification and in claims 2, 10, and 11 as originally presented. Accordingly, no new matter has been added to the claims. No new matter has been inserted into the application.

**Specification**

The disclosure has been objected to because paragraph 79 recites the word ammonium chloride in error. The Examiner points out that ammonium hydroxide should have been used instead. Applicant believes that paragraph 79 refers to the paragraph number in the published application US 2005/0207964A1 which follows different paragraph numbering scheme compared to the original specification as filed. Accordingly, paragraph [0083] in the original specification as filed has been amended as suggested by the Examiner. Accordingly, this objection has been overcome.

**Rejection Under 35 U.S.C. §112, Second Paragraph**

Claims 1-20 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Applicants traverse this rejection. Reconsideration and withdrawal thereof are respectfully requested.

With regard to claim 1, the Examiner states that the phrase “producing a catalytic metal using the magnetic fluid” is unclear because it appears to the Examiner that the catalytic metal and the magnetic fluid are essentially same. The Examiner further states that the phrase “catalytic metal” recited throughout the claims including claim 1 is unclear because the Examiner believes that the “catalytic metal” appears to be iron oxide and iron oxide is a metal compound and not a metal. In response, “catalytic metal” has been amended to “catalytic metal compound” in claims 1, 2, 4, 10-13, 16, and 18. Therefore, Applicants submit that the claim language is definite.

With regard to claim 9, the Examiner states that the phrase “added several times with interval” is indefinite. In response, claim 9 has been amended to recite “added several times in intervals”. Therefore, Applicants submit that the claim language is definite. Accordingly, withdrawal of this rejection is respectfully requested.

**Rejection Under 35 U.S.C. §103(a) Over Jiao ‘453 (US Application Publication 2005/0260453) in view of Khalafalla ‘294 (US Patent 4,208,294)**

Claims 1, 3, 10, 12, 14, and 16-20 have been rejected as being “obvious” over Jiao ‘453 in view of Khalafalla ‘294. Applicants traverse this rejection. Reconsideration and withdrawal thereof are respectfully requested.

**The Presently Claimed Invention**

The presently claimed invention is directed to a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes.

#### Jiao '453

Jiao '453 describes a method for synthesizing nanoscale structures in defined locations. However, Jiao '453 fails to disclose or suggest a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes.

#### Khalafalla '294

Khalafalla '294 describes a dilution stable water based magnetic fluid which is provided by dispersing magnetic particles in water with the aid of a C<sub>10</sub>-C<sub>15</sub> aliphatic monocarboxylic acid. However, Khalafalla '294 fails to disclose or suggest a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes.

Distinctions of the Presently Claimed Invention Over the Cited References

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also *In re Lee*, 277 F.3d 1338, 1342-44, 61 USPQ2d 1430, 1433-34 (Fed. Cir. 2002) (discussing the importance of relying on objective evidence and making specific factual findings with respect to the motivation to combine references); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). MPEP 2143.

In order to establish *prima facie* obviousness of the invention over the cited references, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine reference teachings. The Federal Circuit has produced a number of decisions overturning obviousness rejections due to a lack of suggestion in the prior art of the desirability of combining references, as discussed in the aforementioned section. In the present situation, the Examiner has failed to establish *prima facie* obviousness of the present invention over Jiao '453 in view of Khalafalla '294.

Jiao '453 is concerned solely with a method for synthesizing nanotubes directly at defined locations by providing a substrate and depositing a catalytic material in a defined location on the substrate. Khalafalla '294 fails to remedy the deficiencies in Jiao '453 in failing

to disclose or suggest a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes because Jiao '453 discloses merely preparation of a dilution-stable magnetic fluid. Therefore, both Jiao '453 and Khalafalla '294 fail to be relevant to the presently claimed invention. Moreover, it is believed that claim 1, which has been amended to further clarify the presently claimed invention by incorporating the limitation of now canceled claims 2, 10, and 11, and claims 3, 12, 14, and 16-20, which ultimately depend from claim 1, are novel and unobvious over the cited references.

**Rejection Under 35 U.S.C. §103(a) Over Jiao '453 in view of Khalafalla '294, and further in view of Koikeda '308 (US Patent 4,662,308)**

Claims 1-2 and 15 have been rejected as being “obvious” over Jiao '453 in view of Khalafalla '294, and further in view of Koikeda '308. Applicants traverse this rejection. Reconsideration and withdrawal thereof are respectfully requested.

Jiao '453 is discussed above.

Khalafalla '294 is discussed above.

**Koikeda '308**

Koikeda '308 is cited for the disclosure of a step of adding a binder to the catalytic metal. Koikeda '308 discloses a catalyst suitable for use in the production of hydrocarbons from the synthesis gas comprising an iron-containing Fischer-Tropsch catalyst, a zeolite and at least one

metal selected from the group consisting of ruthenium, rhodium, platinum, palladium, iridium, cobalt and molybdenum. However, Koikeda '308 fails to disclose or suggest a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes.

#### Distinctions of the Presently Claimed Invention Over the Cited References

The Examiner has failed to establish *prima facie* obviousness of the presently claimed invention. There fails to be motivation to combine the cited references to arrive at the presently claimed invention as none of the cited references in combination or independently discloses or suggests a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes as in the presently claimed invention.

The presently claimed invention relates to a method of synthesizing carbon nanotubes from magnetic fluid by thermal chemical vapor deposition which is characterized by (i) adding a binder to a catalytic metal compound produced from the magnetic fluid and (ii) coating the catalytic metal compound on a substrate by injection or dipping.

Magnetic nanoparticles deposited on a substrate tend to agglomerate with the evaporation of a solvent and thus, the nanoparticles cannot retain uniform size and shape during the growth

of nanotubes. The presently claimed invention overcomes this problem by addition of a binder. Further, the presently claimed invention places the catalytic metal compound on the substrate by injection or dipping-coating, but not by a conventional “thin film deposition”, therefore producing highly productive carbon nanotubes at low cost.

As discussed above, combination of Jiao ‘453 and Khalafalla ‘294 fails to arrive at the presently claimed invention as none of these references in combination or independently discloses or suggests a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes. Koikeda ‘308 fails to remedy the deficiencies in Jiao ‘453 and Khalafalla ‘294. In particular, Koikeda ‘308 pertains to the production of hydrocarbons having a high quality and a boiling point range of gasoline from mixed gases of carbon monoxide and hydrogen (synthesis gas), and thus belongs to a field which is completely different from the field of the presently claimed invention contrary to the Examiner’s belief that Jiao ‘453, Khalafalla ‘294, and Koikeda ‘308 are analogous art. Moreover, Koikeda ‘308 discloses merely the use of Fischer-Tropsch catalyst with a zeolite, but not the use of magnetite nanoparticles with a binder as in the presently claimed invention. Therefore, Koikeda ‘308 is not applicable to the presently claimed invention. Accordingly, it is believed that the presently claimed invention is not obvious over the cited references.

**Rejection Under 35 U.S.C. §103(a) Over Jiao ‘453 in view of Khalafalla ‘294, and further in view of Snow ‘072 (US Application Publication 2004/0192072)**

Claims 1, 11 and 13 have been rejected as being “obvious” over Jiao ‘453 in view of Khalafalla ‘294, and further in view of Snow ‘072. Applicants traverse this rejection. Reconsideration and withdrawal thereof are respectfully requested.

Jiao ‘453 is discussed above.

Khalafalla ‘294 is discussed above.

**Snow ‘072**

Snow ‘072 is cited for a step wherein the catalytic metal is coated on the substrate by dipping the substrate in a catalytic metal solution. Snow ‘072 discloses an electronic device comprising an interconnected network of carbon nanotubes on the surface of a substrate, and two or more electrical leads. However, Snow ‘072 fails to disclose or suggest a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes.

**Distinctions of the Presently Claimed Invention Over the Cited References**

As discussed above, Jiao ‘453 and Khalafalla ‘294 fail to arrive at the presently claimed invention in combination or independently. Moreover, Snow ‘072 fails to remedy the deficiencies in the above-mentioned references. Accordingly, the presently claimed invention is not obvious over the cited references.



**Rejection Under 35 U.S.C. §103(a) Over Jiao ‘453 in view of Khalafalla ‘294 and Koikeda ‘308, and further in view of Tsuda ‘471 (US Patent 6,261,471)**

Claims 1-10, 12 and 14-20 have been rejected as being “obvious” over Jiao ‘453 in view of Khalafalla ‘294 and Koikeda ‘308, and further in view of Tsuda ‘471. Applicants traverse this rejection. Reconsideration and withdrawal thereof are respectfully requested.

Jiao ‘453 is discussed above.

Khalafalla ‘294 is discussed above.

Koikeda ‘308 is discussed above.

**Tsuda ‘471**

Tsuda ‘471 is cited for the disclosure of a step adding water and acetone to the aqueous iron chloride solution to separate the magnetite particles from liquid. Tsuda ‘471 discloses a magnetic fluid composition comprising a carrier liquid and magnetic particles covered with at least one surfactant. However, Tsuda ‘471 fails to disclose or suggest a method for synthesizing carbon nanotubes using magnetic fluid by thermal chemical vapor deposition, which comprises the steps of: (S1) producing a catalytic metal compound using the magnetic fluid, and then adding a binder to the catalytic metal compound; (S2) coating the produced catalytic metal compound on a substrate by injection or by dipping the substrate in a catalytic metal compound solution; and (S3) synthesizing the carbon nanotubes.

**Distinctions of the Presently Claimed Invention Over the Cited References**

As discussed above, not all of Jiao ‘453, Khalafalla ‘294, and Koikeda ‘308 are analogous art, thus their combination failing to arrive at the presently claimed invention. Moreover, Tsuda ‘471 fails to remedy the deficiencies in the above-mentioned references.

Accordingly, it is believed that the presently claimed invention is not obvious over these cited references.

**Conclusion**

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to JHK Law's Deposit Account No. **502486** during the pendency of prosecution of this application. Should such additional fees be associated with an extension of time, applicant respectfully requests that this paper be considered a petition therefor.

Respectfully submitted,

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